Expected Range of Knowledge
California Department of Health Services
Water Distribution Operators

To the left of each subject area all grades will be an expected skill range as follows:
N/A = Not Applicable
S = Small System Operator A person who generally works alone on a system that meets the regulatory definition of a small water system. A small water system serves a population of 1,000 or less. This individual has a general understanding of all concepts listed below as they pertain to small systems.
A = Apprentice A person who generally works under the supervision of a more skilled person. Has a general understanding of all concepts listed below and functions at the novice level.
J = Journey Person An experienced, competent worker. Has a high level of understanding of all concepts listed below and performs with minimal supervision.
M = Master A highly skilled person who has a complete understanding of all concepts listed below and performs with no supervision.

Water Distribution Mathematics **Grade Level**	**1**	**2**	**3**	**4**	**5**
Water Terms & Definitions	S	A	J	M	M
Water measurements	S	A	J	M	M
Formulas (area and volume)	S	A	J	M	M
Units and conversion factors	N/A	A	J	M	M
Water pressure	S	A	J	M	M
Calculation of dosage, feed rates, and flow rates	N/A	N/A	A	M	M
Calculation of horsepower requirements	N/A	N/A	N/A	A	M
Calculation of electrical costs for pumping	N/A	N/A	N/A	A	M
SCADA signal calculations, i.e., 4-20 mA	N/A	N/A	N/A	A	M

Distribution System Operation **Grade Level**	**1**	**2**	**3**	**4**	**5**
Purpose, configuration, operation	S	A	J	M	M
Pipe materials	N/A	A	A	J	M
Static head -- meaning and significance	S*	A	J	M	M
Water storage facilities -- types and purpose	S	A	J	J	M
Valve types and uses	N/A	A	J	M	M
Meters	S	A	J	J	M
Hydrants	S	A	J	J	M
Leak detection and repair	N/A	N/A	A	J	M
Corrosion -- causes, effects, control	N/A	N/A	A	J	M
Flushing and cleaning	N/A	A	J	J	M
Cross-connection and backflow devices use and maintenance	N/A	A	A	J	M
Water meter testing, maintenance and repair	N/A	A	A	J	M
Maintenance of pumps and electric motors	S	A	J	J	M

Piping	**Grade Level**	**1**	**2**	**3**	**4**	**5**
Effect of pipe size, type and C factor		N/A	A	J	J	M
Standard installation, operating capacities and pressures		N/A	A	J	M	M
Head loss in pipes -- causes, significance		N/A	A	J	M	M
Tuberculation -- causes and effects		N/A	A	J	M	M
Joints and fittings		N/A	A	J	M	M

Sources of Supply	**Grade Level**	**1**	**2**	**3**	**4**	**5**
Chemical, physical, and bacteriological characteristics; variability		S	A	J	J	M
Groundwater and surface water supplies		S	A	J	M	M
Hydrologic cycle		S	A	J	M	M
Well location, construction, and yield		S	A	J	M	M
Sanitary surveys		N/A	N/A	A	J	M
Watershed management		N/A	N/A	A	J	M

Water Quality	**Grade Level**	**1**	**2**	**3**	**4**	**5**
Elements, compounds, hardness, pH		N/A	A	J	J	M
Significance of organics and inorganics		N/A	A	J	J	M
Sampling requirements, techniques		S	A	J	M	M
Coliform group -- occurrence, significance		S	A	J	M	M
Heterotrophic bacteria		N/A	A	J	J	M
Potential waterborne diseases		S	A	J	M	M
Cross connection significance and prevention		S	A	J	J	M
Disinfection by-products, i.e., THM's		N/A	A	J	J	M

Disinfection	**Grade Level**	**1**	**2**	**3**	**4**	**5**
Purpose of disinfection		S	J	M	M	M
Disinfectant types		N/A	A	J	J	M
Characteristics of chlorine and chlorine compounds (gas/liquid)		S	A	J	M	M
Chlorine demand -- significance, and relationship to dose		S	A	J	J	M
Residual measurement methods and reagents used		S	A	J	J	M
Chlorine storage, feeding and measurements		S	A	J	J	M
Chlorine containers		N/A	A	J	J	M
Detection of leaks		N/A	A	J	J	M
Hazards and safety requirements		S	A	J	M	M
Disinfection by-products; THMs		N/A	A	J	J	M
Breakpoint chlorinaiton -- meaning, significance, determination		N/A	A	J	M	M
Effects of pH, turbidity and temperature on chlorination		S	A	J	M	M
Free Vs combined chlorine		N/A	A	J	M	M
Standard disinfection methods for new/repaired mains and storage facilities		S	A	J	M	M

Pumps and Motors	Grade Level	1	2	3	4	5
Types of pumps		S	A	A	J	M
Operational principles		N/A	A	J	J	M
Mechanical components of centrifugal and positive displacement pumps		N/A	A	J	J	M
Static, dynamic, suction and discharge head		N/A	A	J	M	M
Motors/Drives		N/A	A	J	M	M
Chemical feeders		N/A	A	J	M	M
Causes of water hammer and cavitation		S	A	J	M	M
Routine preventative maintenance (packing, bearings, alignment, priming)		S	A	J	J	M

Electricity (Water Related)	Grade Level	1	2	3	4	5
Units (amps, ohms, watts, volts)		S	A	A	J	J
Current flow; AC/DC		N/A	A	A	J	M
Circuits		N/A	A	A	J	J
Lock-out/tag-out		S	A	J	M	M
Horsepower		N/A	N/A	A	J	M
Electrical controls		N/A	A	A	J	M
Generators		N/A	A	J	J	M
Transformers		N/A	A	J	J	M
SCADA Systems		N/A	A	J	J	M

Safety	Grade Level	1	2	3	4	5
General		S	J	J	M	M
Basic first aid		N/A	A	J	M	M
Traffic Control		N/A	A	J	J	M
Trenching and shoring		S	A	J	J	M
Confined spaces		S	A	J	J	M
Respiratory protection		N/A	A	J	J	M
OSHA Compliance		S	N/A	A	J	M

Utility Management	Grade Level	1	2	3	4	5
Planning		N/A	N/A	A	J	M
Personnel		N/A	N/A	A	J	M
Maintenance management		N/A	N/A	A	J	M
Information management		N/A	N/A	A	J	M
Public relations		S	N/A	A	J	M
Emergency response		S	N/A	A	J	M
Finance		N/A	N/A	A	J	M
Water rates		N/A	N/A	A	J	M
Safety administration		N/A	N/A	A	J	M
Security		S	N/A	A	J	M